PIC/JR-1024/61
[redacted] June 1961

JOINT PHOTOGRAPHIC INTELLIGENCE REPO[redacted]

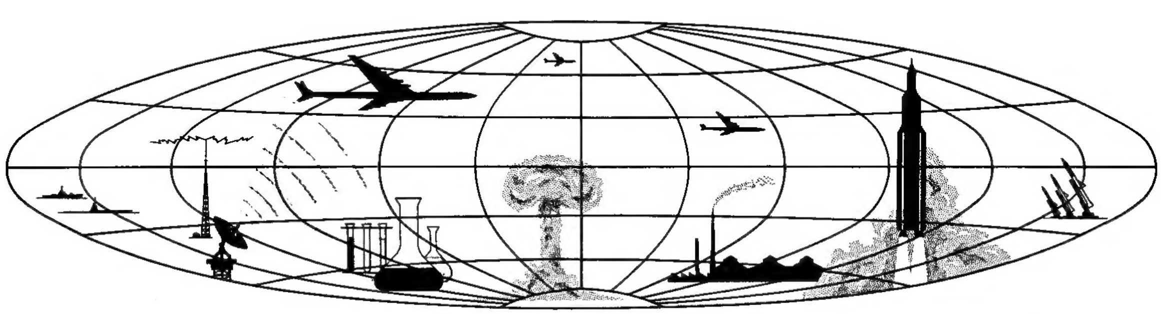
URANIUM MINING AND[redacted]LLING COMPLEX

MAYLI-SAY, USSR

[redacted]

ARMY NAVY CIA

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER



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JOINT PHOTOGRAPHIC INTELLIGENCE REPORT

URANIUM MINING AND MILLING COMPLEX

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PREFACE

This joint photographic intelligence report has been prepared by the Army, Navy, and Central Intelligence Agency. Its scope is intended to meet the combined requirements of the intelligence community as specified by the Joint Atomic Energy Intelligence Committee (JAEIC).

This report utilizes all intelligence information available as of 1 June 1960, but it is confined to information directly related to the photographic evidence. Supporting geological, economic, and manufacturing data remain on file at PIC.

All measurements used in this report to define the plant at Mayli-Say were made from oblique photography, and may be in error by as much as plus or minus 5 percent.

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SUMMARY

25X1D

Photography of [redacted] reveals that a large modern uranium ore concentration plant, of approximately 1,000 tons daily ore capacity, is producing concentrates derived from the ore of 13 satellite mines in the vicinity of Mayli-Say. The plant is composed of an ore-crushing mill, a chemical concentration mill believed to use the carbonate leach process, and a dispatch facility. A tailings dump near the plant indicates that 2,373,000 metric tons of ore was processed during 1950-57. A thermal electric power plant, adjacent to the ore concentration plant, generates power for the entire mining and milling complex. It is estimated that the concentration plant was producing an annual rate of 700 tons of uranium oxide in 1957, and that the production rate was steadily increasing. The photography also confirms the probability of a relationship of the Mayli-Say plant with a supply base at the Andizhan II railhead. Photography of [redacted] was of such quality that nothing could be ascertained except that the power plant was operational at that time.

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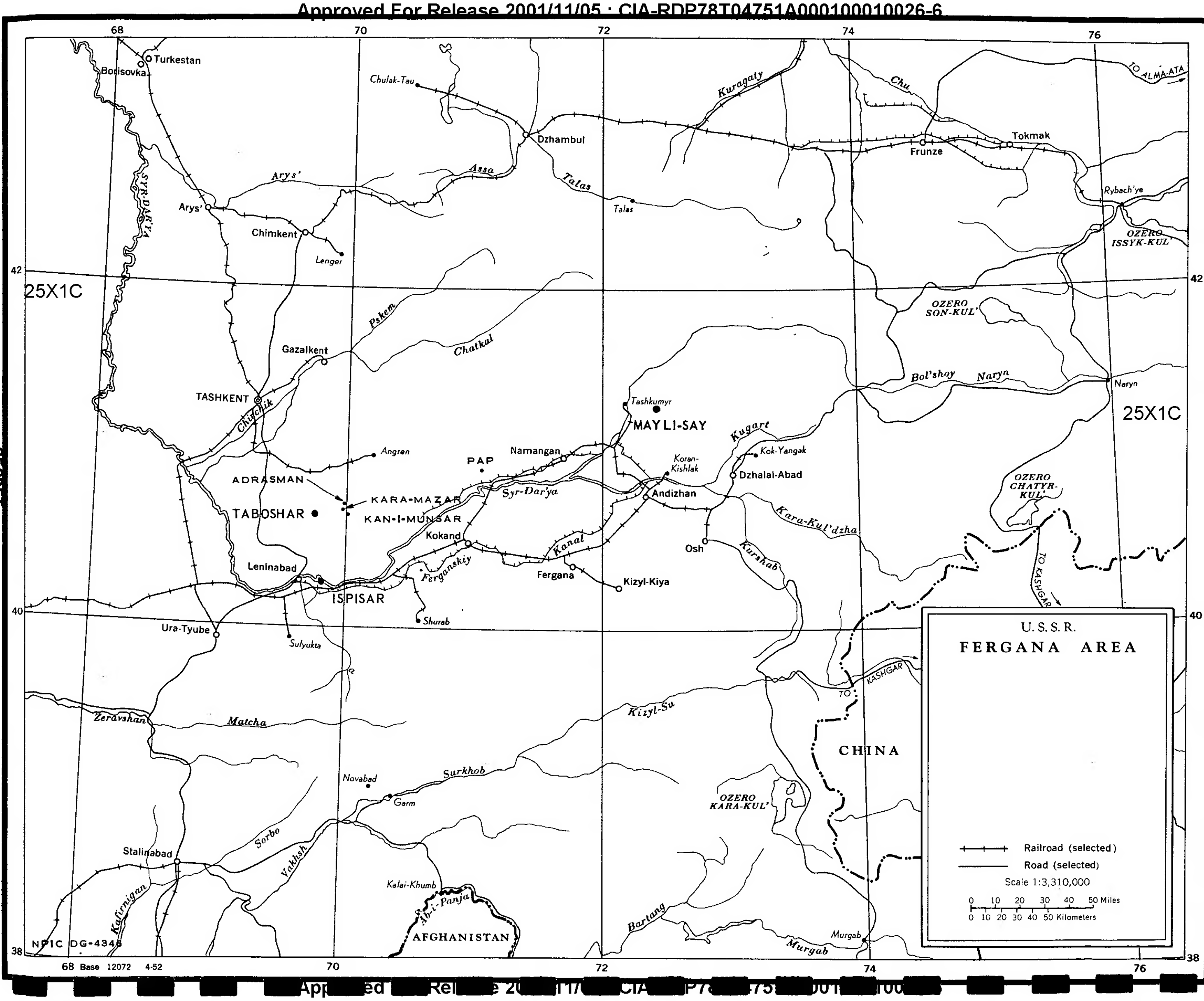

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INTRODUCTION

The Mayli-Say uranium mining and milling complex (41-15N 72-28E) is located along the northern periphery of the Fergana valley in the Kirgiz SSR (see location map). It is composed of a uranium ore concentration plant, located in the valley of the Maylisu river, and 13 mines in the surrounding Chaak-Tau (mountains). The Mayli-Say enterprise was little known until the good quality, oblique photography of [redacted] (Figures 1, 2, and 3) which permits this analysis of the complex. 25X1D

It is believed that the concentration plant began as a relatively small enterprise prior to World War II at a site immediately north of the town of Mayli-Say. Construction of the present plant apparently started immediately after the war, and production probably commenced in 1950.

The purpose of this report is to identify the various components of the plant and the supporting installations, and to analyze the flow and rate of production.

GEOLOGY

The discovery of uranium at Mayli-Say was announced by Yu. M. Golubkova in July 1934. 1/ It was described as occurring 400 feet above the west bank of the Maylisu river. This description fits very well the setting for mine No 5* (see Figure 3). Golubkova states that the vein though hidden by vegetation which is still visible on the [redacted] photography, was a bed 30 inches thick. Her description of the original deposits placed them on the south flank of an anticline between two zones of crushed and sheared limestones and sandstones of the Fergana group of consolidated sediments. 1/ The uraniferous phosphates and vanadates produced by weathering carried the unusually high grade of one to three percent ura- 25X1D

* Mine numbers have been arbitrarily assigned in a clockwise direction, beginning at the 12 o'clock position.

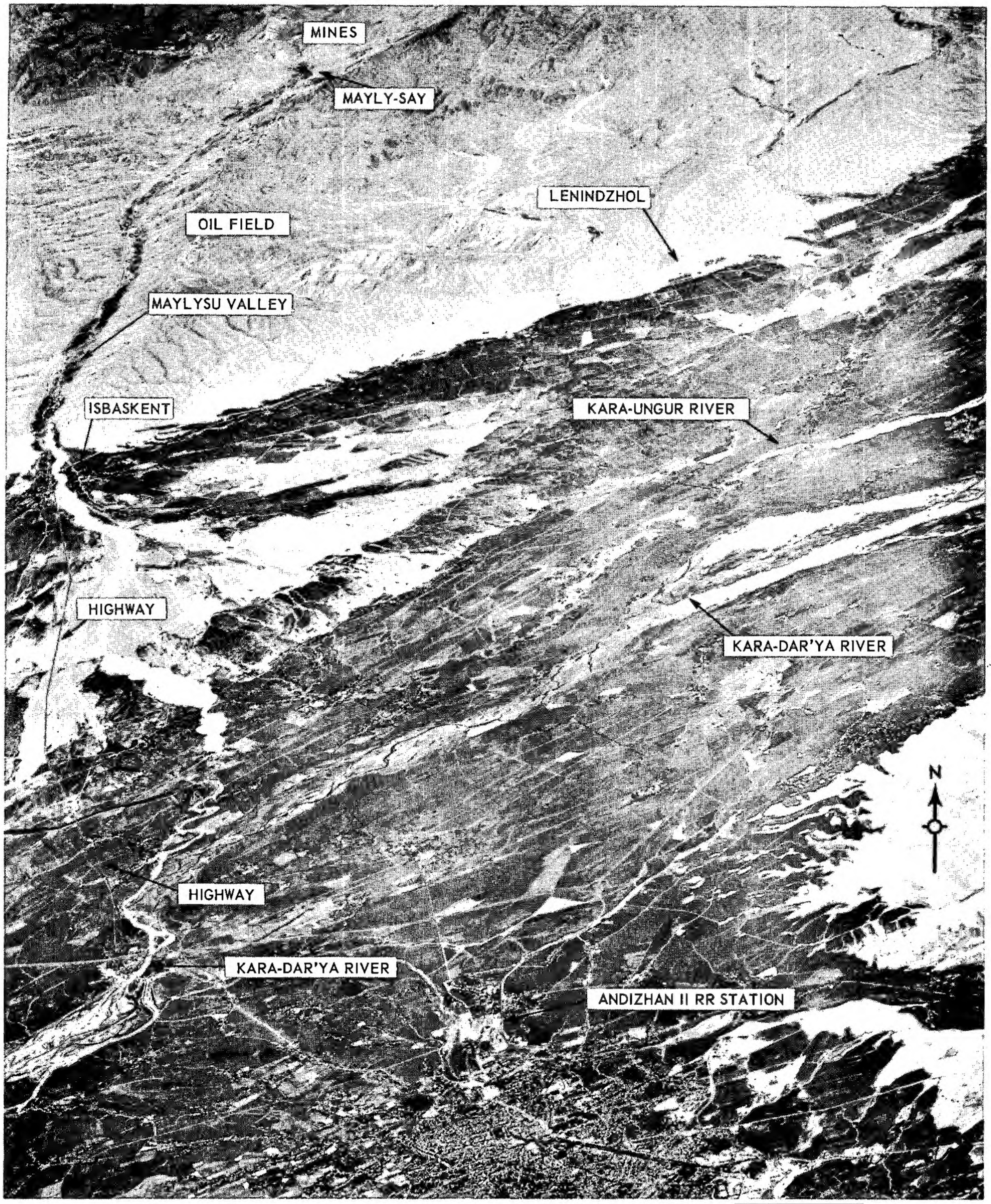

FIGURE 1. MAYLI-SAY AND ANDIZHAN REGION (Photography of [redacted] 25X1D

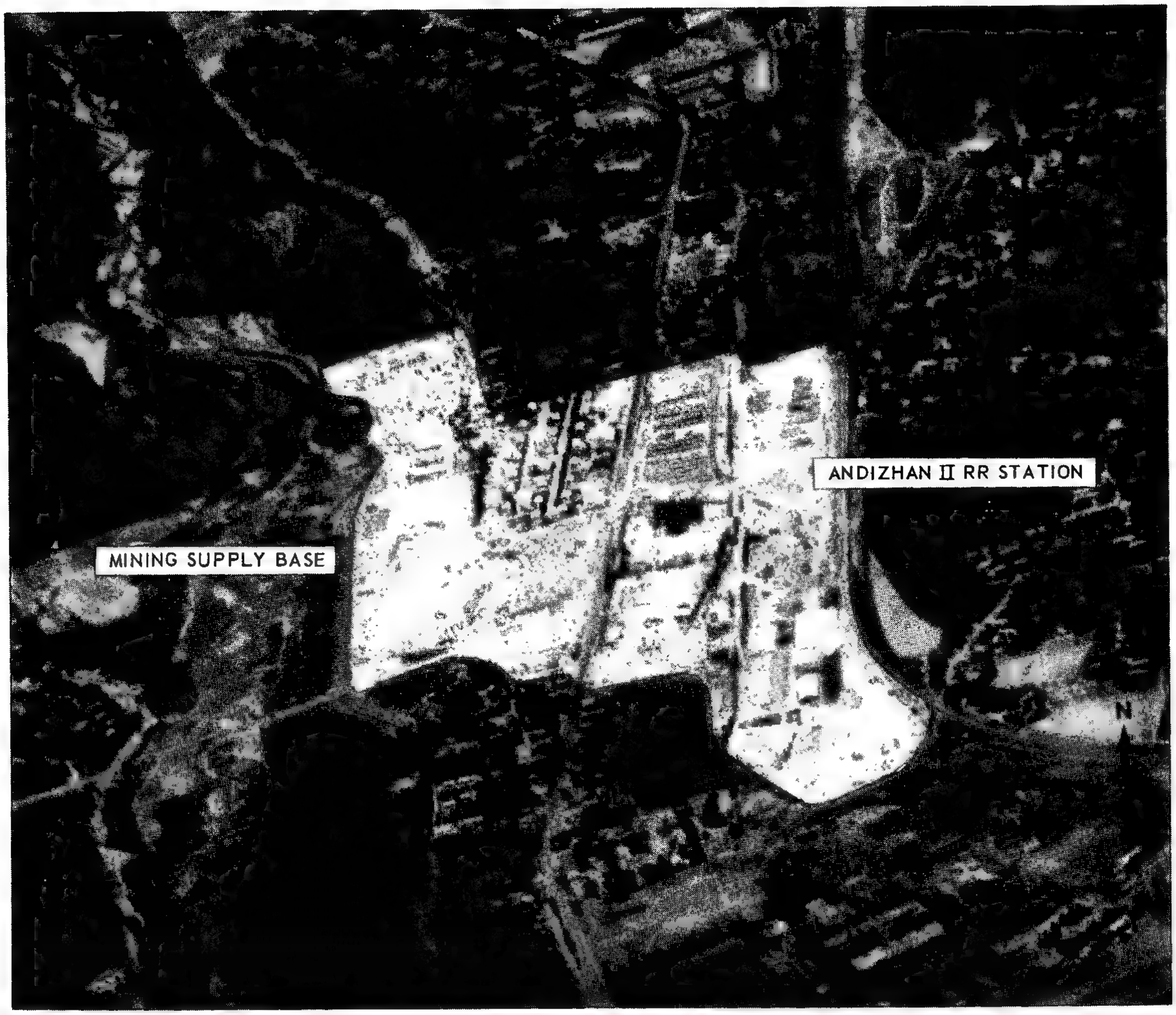

FIGURE 2. MINING SUPPLY BASE AT ANDIZHAN II RR STATION. This is believed to be the supply base for the Mayli-Say uranium operation.

nium oxide. An investigation of nearby spring waters and oil showed that they were radioactive.

The US Geological Survey report on this area states that the uranium deposits are localized in an asymetrical anticline, 2/ an analysis which is confirmed on the photography. It is felt that structure is the dominant influence in localizing the ore bodies. Mining can be seen at varying elevations indicating that there is no singular contour or bed associated with the deposits. It is thought that the intersection of the anticline with the

main Mayli-Say fault, which parallels the Maylisu valley, served as a locus for the accumulation of uranium. Uranium-bearing solutions might have migrated along and through the anticline until they reached the fractured and displaced zone along the Mayli-Say fault, where the uranium was precipitated.

According to the US Geological Survey study, the uraniferous minerals occur in a limestone of Tertiary age. The uraniferous limestone is classed as a high-lime ore, and therefore is treated by a carbonate leach process, rather than by the customary acid leach method. The uranium ore has been identified mineralogically by V. G. Melkov as composed of tyuyamunite torbernite, and autunite. 3/ The grade of the secondary ore near the surface has been reported but no assessment is available for the primary ore which is probably the main source. However, to justify a large operation of the type seen at Mayli-Say, a grade of 0.2 to 0.3 percent uranium oxide must be assumed as a minimum.

It is probable that the Mayli-Say region has been thoroughly prospected. However, the usual surface indications, such as pitting and trenching are missing. Two shallow prospecting pits are found in the middle course of the Abdyy river. One deep-well drilling rig, probably conducting a deep stratigraphic test, is located not far from the west bank of the Maylisu river below the prominent ridge on which mine No 6 is located (see Figure 3). The small amount of surface prospecting is probably due to the steeply dipping uranium-bearing beds, which descend too abruptly to make surface prospecting worth the cost and effort. Prospecting must accordingly be conducted underground from the mine workings themselves.

The US Geological Survey report also states that there are radioactive oilfield brines and springs in the Maylisu valley near Mayli-Say. 2/ There is no photographic evidence that these waters are being exploited for their mineral contents.

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FIGURE 3. MINING AND MILLING COMPLEX, MAYLI-SAY, USSR. (Photography of [redacted]

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MINES

The prewar uranium mines and facilities at Mayli-Say are still partly visible, but their exact nature and number cannot be determined because of their semidefilade position in the Maylisu defile near mine No 5 (see Figure 3). The mining of the richer secondary ores probably began about 1938, accompanied by hand-sorting of the richer ore and the dumping of lean ore and mine waste. Possibly at this time the terraced dump was started in a deep ravine, descending into the defile directly across from the original mine.

Sixteen mines have been identified from aerial photography of the Mayli-Say district. Of these 13 are uranium mines and 3 are coal mines. All of the mines in the Mayli-Say area are underground operations. No open-cut mines have been discovered, except for the early mining of secondary deposits at mines No 1 and 6.

Five of the 13 uranium mines operate by vertical shafts and 8 by means of adits or tunnels. The shafts are surmounted by characteristic steel headframes. Hoist houses, small personnel buildings, and temporary storage buildings for ore and supplies are found near each headframe.

The structures at the mines are given in Table 1, which is keyed to Figure 3.

In addition to the structures closely associated with the mines, two storage or maintenance buildings are located midway up on a ropeway trace or route (see Figure 3). A combined powerhouse and storage building is located at the junction of the mountain road to mines No 2, 3 and 4 with the main road from the Mayli-Say uranium complex to the town of Mayli-Say.

There are no barracks visible at any of the mines. The miners and workers probably travel by truck or bus from the housing areas or the city to the mines.

TABLE 1. URANIUM MINE OPERATIONAL AND STRUCTURAL DATA.

Mine	Houses	Production Bldgs.	Storage Bldgs.	Admin & Security Bldgs.	Access	Dumps	Remarks
1	-	-	-	-	3 Adits	3	-
2	4	5	4	2	2 Shafts	*	-
3	-	8	1	2	Shaft	*	-
4	-	4	2	4	Shaft & Adit	3	-
5	3	4	3	2	Shaft**	3	-
6	-	-	-	-	3 Adits	2	May be part of mine No 5
7	-	-	-	-	2 Adits	2	-
8	-	-	-	-	Adit**	1	-
9	-	-	-	-	Adit	1	May have various levels
10	-	-	-	-	Adit	1	-
11	-	-	-	-	Shaft	1	-
12	-	-	-	-	3 Adits	3	-
13	-	-	-	-	Adit	1	May use supply bldg west of new mill
14							
Totals	7	21	10	10		21	

* Dump has been leveled to provide for a better mine site.
** Adit/shaft is in partial defilade position and all access ways may not be visible.

No storage tanks can be seen at any of the mines. Any processing of the ores probably is confined to mechanical concentration methods.

Electric power for the mining probably is supplied by the centrally located power station, supplemented by a tie-in line to the Uzbek regional grid. The power lines to the mines cannot be completely traced. To provide the mines with emergency power, it seems probable that generating facilities capable of producing sufficient power for hoists, pumps, ventilators, and illumination must be available at each mine.

All the mines probably are served by trucks. Most of the roads of the mines appear to be well traveled, and sufficiently wide for two trucks to pass. The faint trace of a ropeway, or overhead tramway, from the escarpment on which mine No 4 is located to the Maylisu valley floor, suggests the movement of some ore and supplies by this means.

A pipeline is visible between mine No 2 and the valley floor, but its function has not been determined. A pumphouse in the Maylisu defile serves this pipeline.

URANIUM PLANT

The uranium plant is located on the west bank of the Maylisu river above its junction with the Abdyy river, 2 statute miles north of the town of Mayli-Say.

Plant Layout

The mill site is roughly a rectangular area about 800 feet long and varying from 440 to 585 feet wide (the south side of the mill area has no fence and its perimeter can only be approximate).

The three main processing buildings are located on a terrace which slopes both downstream (south) and riverward (east), or with a general or vector slope towards the southeast (see Figure 4).

A court, 200 by 140 feet and open at the west, is formed between the north and south wings and the north-south connecting axis of the mill buildings. The courtyard is filled with several piles of dark-toned unidentified materials, possibly piles of ore or supplies.

The buildings were constructed some years ago, and there was no evidence of any recent construction, remodeling, or repair at the time of the photography.* The construction of the crushing and grinding buildings on a slope enables heavy ores to be moved with the aid of gravity.

* Across the Maylysu river from the north end of the tailings dump is a fenced area with three parallel streets connected by two end streets. Along the streets are about 25 abandoned tent or rough dwelling sites and 2 common buildings, believed to be an old construction workers camp. Access to the mill site was gained by a portable bridge which still lies drawn up on the east bank of the Maylysu river across the Mayli-Say highway from the old abandoned construction workers camp site. A POW interned at Chauma, south of Isbaskent (41-03N 72-12E) observed trucks carrying an estimated 240 men (said to have been Russian soldiers who were former POWs of the German Army) headed north during 1946-47 toward an unknown construction project. [redacted]

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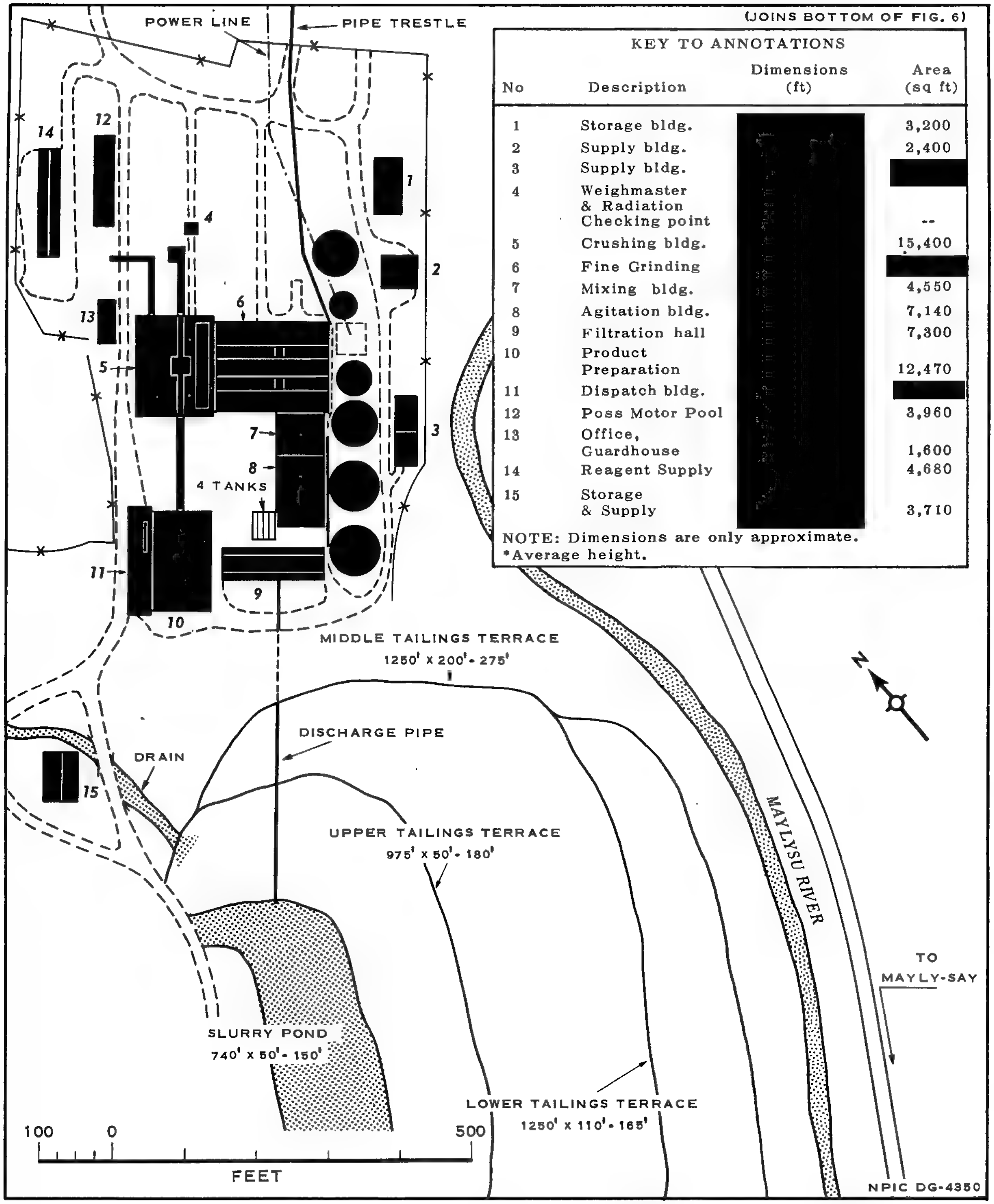

KEY TO ANNOTATIONS

No	Description	Dimensions (ft)	Area (sq ft)
1	Storage bldg.	[redacted]	3,200
2	Supply bldg.		2,400
3	Supply bldg.		[redacted]
4	Weighmaster & Radiation Checking point		--
5	Crushing bldg.		15,400
6	Fine Grinding		[redacted]
7	Mixing bldg.		4,550
8	Agitation bldg.		7,140
9	Filtration hall		7,300
10	Product Preparation		12,470
11	Dispatch bldg.		[redacted]
12	Poss Motor Pool		3,960
13	Office, Guardhouse		1,600
14	Reagent Supply		4,680
15	Storage & Supply		3,710

NOTE: Dimensions are only approximate.
*Average height.

25X1D

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25X1D

FIGURE 4. URANIUM PLANT AND ASSOCIATED BUILDINGS, MAYLI-SAY, USSR.

Production Buildings

The seven production buildings are described below (see also Figure 4), in the order of the flow of ore and concentrates through the plant:

Building 5 - Crushing Building. The building stands at the northwest corner of the U-shaped mill complex, adjoining the fine grinding hall. The upper part of its westward-pitching roof has a large dormer-type ventilator over the crushers. An ore storage bin 25 feet square rises above the center of the building. The bin is served by two conveyers from the north and south. It is not possible to determine the bin's height. However, its apparent size and height suggests a capacity of 18,000 cubic feet, capable of holding about 1,000 metric tons of uranium-bearing limestone ore, or one day's supply for the mill.

Building 6 - Fine-Grinding Hall. The roof of this three story, rectangular building has three full-length longitudinal monitors. The monitors are separated near their east ends by two higher square structures which may house tanks or hoisting engines. A narrow conveyer located at the northwest corner of the crushing building is used to introduce reagents to the fine-grinding hall from a supply shed.

Buildings 7 and 8 - Mixing and Agitation. The mixing and agitation buildings adjoin the fine-grinding and filtration buildings. The smaller northern building, No 7, possibly houses additional agitation and leaching tanks from which slurries are drawn for processing by the nearby thickeners. The larger southern building, No 8, probably houses most of the leaching tanks of the latter. Filter equipment may also be housed here for treating the underflow product of the thickeners.

At the southwest corner of building 8 are four elevated tanks occupying an area 40 by 35 feet. The tanks probably contain liquid reagents, possibly acids for neutralizing the spent liquids in the filtration hall of the south.

Building 9 - Filtration Hall. The filtration hall is a long, relatively low building with two dark, rectangular parapets at each end connected by a wide longitudinal monitor. These parapets may conceivably function as supporting members for a device to open the monitors particularly wide to release heat and noxious fumes, especially during the hot summers of the semiarid Fergana valley.

25X1D A large [redacted] overhead pipe emerges from the center of the south side of the filtration hall and empties into the north side of the slurry pond, 485 feet away. The slurry pond indicates that the pipe's discharge is a whitish slime or slurry, resembling the light-toned, fine-grained product visible on certain mine dumps in the area.

Building 10 - Product Preparation Building. This warehouse-type building probably contains a dryer for the yellow cake, and a storage room for product storage. It may also contain facilities for upgrading low-grade concentrates received from other mines. In addition, small amounts of ores of different mineralogical character may be received and prepared for treatment by a second or much smaller acid circuit of the mill, as is done by carbonate mills at Beaverlodge, Saskatchewan; and Bluewater, New Mexico.

Building 11 - Dispatch Building. This building is served by a loading and unloading dock where the upgraded product is loaded for shipment to a solvent extraction plant or a metals plant and where some ore is probably received. The building has a rectangular monitor for ventilation and the release of dust.

Conveyers

On the middle of the north side of the crushing building, No 5, is a 100-foot-long conveyer rising 50 feet from a small dark structure which may serve as a combined dump and weighhouse. The conveyer is inclined at an angle of 25 degrees. This greatly exceeds the 18-degree angle recommended for crushed stone and exceeds the 23-degree angle suggested

for dry clay to be carried on belt conveyers. 4/ Thus, it seems likely that this is not a belt conveyer but a pan conveyer for transporting block materials. The conveyer structure is estimated to be 5 feet wide and to have a lift capacity of about 50 tons of ore per hour, or 1,200 tons per day (not far from the estimated 1,000-ton, ore-processing capacity of the mill itself). The first flight rises to the roof of the crushing mill (building 5) where a nearly horizontal 50-foot-long conveyer carries the ore to a tower which probably serves as an ore storage bin for the coarse crusher.

On the opposite side of the crushing building is another horizontal conveyer flight, also 50 feet long, which conveys ore and possibly recycled material from the product preparation building to the ore bin with the aid of a 140-foot conveyer inclined at an angle of 20 degrees. On the basis of the extremes of angles recommended, 4/ this could be a belt conveyer suitable for moving a variety of materials in addition to the uranium ore, which in this case is comparable to crushed stone.

A third and smaller conveyer also rises by two flights, 65 feet and 85 feet long, to a place 25 feet from the northwest corner of the crushing building. The upper or second flight of 85 feet rises to a height of 45 feet. The first flight of 65 feet rises from the ground to a height of 25 feet, passing over a heavily traveled plant road. The [redacted] angle of inclination is within the limits recommended 4/ for raising claylike materials on a belt conveyer. The first flight originates 100 feet from a long rectangular building, which is identified as a reagent supply shed. This conveyer is probably used to convey a powdery chemical reagent into the crushing and grinding building for admixture with the ores. The open-ended arrangement of the lower part of the conveyer indicates that it might also be used for the introduction of rich ores or even for pilot plant purposes on special test ore parcels. At an overall width of [redacted] the two-flight conveyer can raise above 100 tons of materials per hour.

25X1D

25X1D

From the foregoing data it is estimated that the three conveyers are able to raise and to maintain supplies of reagents and ores to the mill at

the rate of 250 tons per hour, substantially in excess of the operating capacity of the mill. Presumably, if the mill were ever enlarged it could be served by the existing conveyers.

Thickeners and Tanks

Six thickeners or tanks are visible at the plant. Data regarding the thickeners and tanks are shown in Table 2.

TABLE 2. THICKENERS AND TANKS AT THE MAYLI-SAY URANIUM PLANT.

25X1D

Diameter (ft)	[redacted]	Estimated Capacity* (metric tons of pulp per day)	Remarks
70		490	Prob storage
40			Prob water treatment
[redacted]			Prob water treatment
70		490	Prob storage or substitution
75		550	
75		550	

25X1D

* Capacity of the thickeners is calculated at the rate of one ton per day per 8 square feet of cross section.

The two 70-foot-diameter thickeners are available for intermediate plant storage, for recycling of fines, or for substitution in case of shutdown of the larger diameter (75 feet) thickeners for repairs. All thickener tanks are semiburied so that their exact depths are unknown, but they are probably 10 to 15 feet deep.

Storage and Supply Facilities

Seven buildings comprise the storage and supply facilities at the Mayli-Say uranium plant (see Figure 4). Three (No 1, 2, and 3) are situated east of the mill along an artificial terrace above the Maylisu river. They have a total roof cover of [redacted]. The other four buildings (No 12-15) are located west of the mill along the main service road. 25X1D

These four buildings have a total roof cover of 13,950 square feet. Two of the buildings west of the mill (No 14 and 15) have light roofs, perhaps to reflect the heat.

Processing

The plant layout appears to be that of a conventional carbonate leach plant and follows a flow scheme that has been used in the US and Canada. The process involves crushing, fine grinding, and agitation leaching with sodium carbonate solutions. This is followed by thickening of the ground product and either returning the thickener underflow to additional leach tanks or, alternatively, filtering the thickened material in two stages of rotary filters or possibly five stages of disc filters.

The sodium carbonate process probably is used for the Mayli-Say limestone ores because it is cheaper than any other process. Other advantages of the sodium carbonate process are: there is less corrosion; the carbonate solutions are easy to regenerate; the lime remains inert; and there is a reduced need for oxidizers.

The flow pattern illustrated in Figure 5 and described below is suggested for the Mayli-Say uranium mill:

1. The crude uranium-bearing ore is trucked inside the mill area where it may be dumped temporarily on bare ground north of the mill, or trucked through the radiation intensity shed (building 4), where the average radiation value of the ore is determined. After the ore has been checked for its radiation intensity it is unloaded at the bottom of the large conveyer north of the crusher building.

Judging from the few small piles of ore on the ground at the time of photography the mill was able to process all of the ore which was being trucked to it. If the mill is forced to shut down for some reason, large piles of ore might accumulate on the bare ground area. The bare ground seems to indicate that large piles of ore have been stored there in the past.

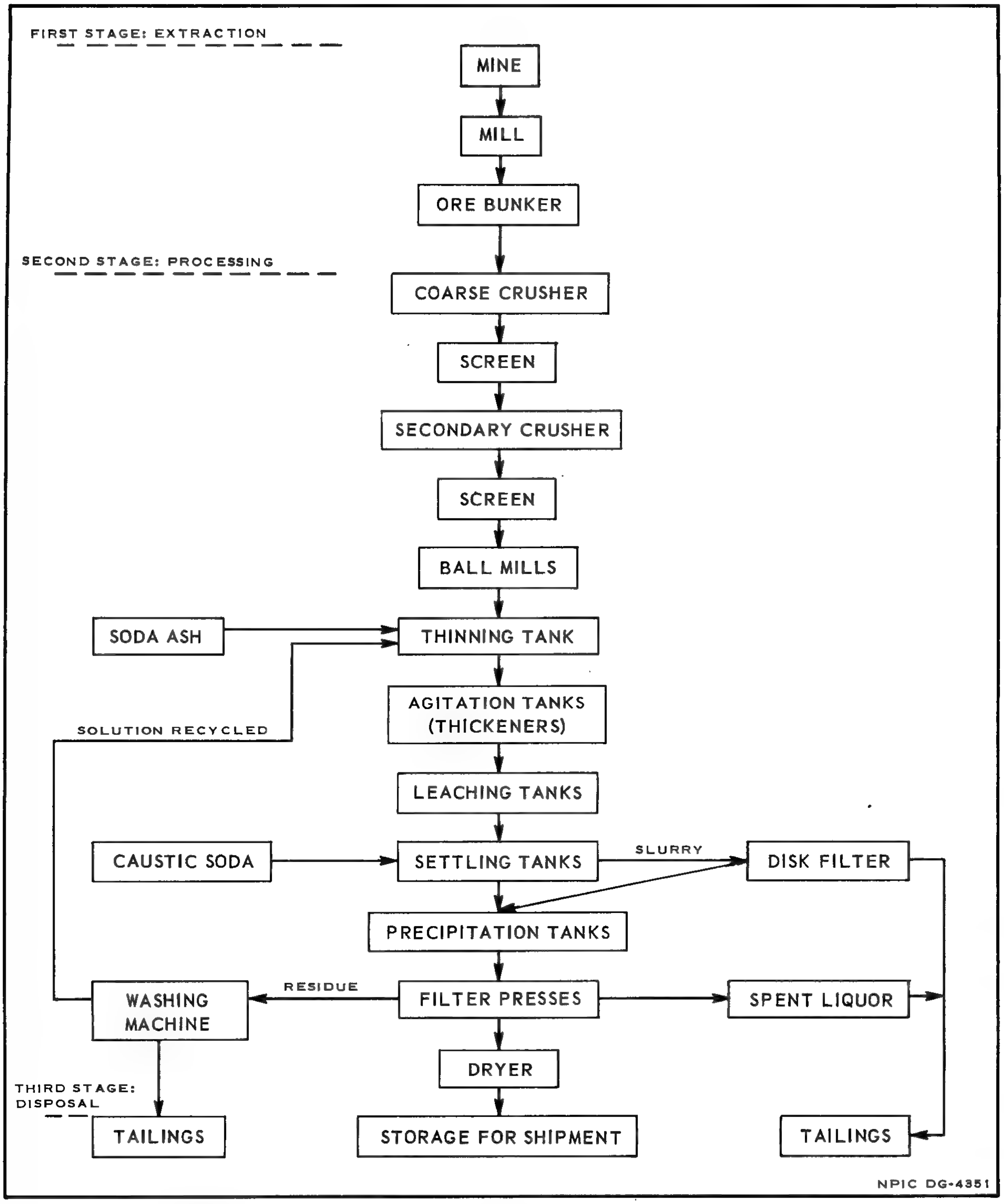

FIGURE 5. FLOW DIAGRAM OF A CARBONATE URANIUM COMPLEX. The processing at Mayli-Say is believed to follow a pattern similar to this.

2. Two conveyers elevate the ore either from a truck or from the bare ground area, or from a retreatment fraction from the recycling, packing, and mill product storage building (building 10) to a temporary storage bin, 25 feet square, in the center of the crushing building (building 5). The bin is estimated to be able to hold a day's supply, 1,000 tons of ore. If concentrates or rich ore are brought to the mill it is possible that they may be specially introduced into the mill circuit through the small conveyer at the northwest corner of the crusher building.

3. The ore descends from the tall storage bin into primary or coarse crushers in the crushing building.

4. The ore moves downward by gravity from the secondary screen bin into the adjoining ball mill area or fine grinding hall (building 6). Here the ore probably is mixed with sodium carbonate and other reagents to promote thorough contact of the finest ore particles with the solvents.

5. The finely ground ore is agitated in tanks at the east end of the fine grinding hall, in building 7, or in one of the northernmost outside thickener tanks.

6. The finely ground and leached ore moves directly from storage or from the leaching tank to the thickeners. The eluate is drawn off from the rim of the thickeners and piped into the southern mixing and agitation building (building 8), where it is strained and clarified. The coarser fraction is pumped from the center of the thickener and, together with any coarse material which might be in the eluate, possibly cycled through a disc filter. The two 75-foot diameter thickeners probably are used for ore settlement. Capacity of these thickeners is estimated to be 880 to 1,100 tons daily. This thickener capacity checks fairly closely with the 1,000 metric tons per day estimated to be treated by the mill on the basis of the size of the tailings pile (see section on capacity and production).

7. Solid caustic soda to precipitate the uranium is probably added to the eluate at the east end of the filtration house (building 9). The eluate is clarified and filtered and the pregnant solution is dried in the filter to form uranium-bearing yellow cake (sodium diuranate). The barren solu-

tion possibly is treated in part for the regeneration of the sodium carbonate reagent.

8. The barren solution and the finely ground limestone are discharged through a pipe into the slurry pond at the top of the tailings area.

9. The yellow cake (sodium diuranate) is taken from the filtration hall into the large product preparation building (building 10). Here it is dried, packed, and stored for shipment by truck to a plant located outside the Maylisu valley for purification and advanced processing.*

The recovery of uranium oxide from the Mayli-Say mill should be from 80 to 85 percent of the uranium oxide equivalent contained in the ore. There is an absence of steam in the plant from stacks or from other sources, but on autunitic ores of the type described in the geology section this would not be necessary, as the ores dissolve very readily in warm carbonate solutions. There is no need for extensive oxidation and, consequently, autoclaves or Pachuca tanks would be unnecessary for treating an autunitic ore.

The grades of ore cited in mineral literature and by the US Geological Survey, derived from big channel samples, probably do not apply to what the Soviet Union presently is mining and milling. The mine production is of considerable magnitude, approximately 1,000 tons of ore per day. One can estimate that the grade of the ore runs 0.2 to 0.3 percent uranium oxide, or similar to what has been most economical in the United States for good production. Lower grade ore can be upgraded to the desired uranium oxide content at the mines and production from that grade of material is worth the capital expenditure. Soviet uranium mills are expensive to construct, and costs would be roughly comparable to mill costs in the United States and the mills would also be comparable in size to US mills. The Soviet mills are of permanent construction and are intended to last a long time with high output. The towns around the plant indicate that the USSR expects a long-term mining operation at Mayli-Say.

* Concentrates from the Mayli-Say mill are such high grade that they would be shipped directly to a metal refinery, rather than to another plant for upgrading.

Waste Disposal

Waste from the plant consists of a small fraction of solids in the form of finely ground rock and a larger proportion of very finely ground rock, reagent, and water in the form of a slurry. The solids are trucked from the southeast corner of the mill over a steep grade down to the lower terrace of the tailings pile where they are dumped. The slurry is discharged through the effluent pipe described above into a slurry pond.

The waste dump is composed of three terraces surmounted by a slurry pond which will eventually form a fourth terrace. The slurry pond is retained by the mountainside on the west and by a retaining wall or dike of tailings material on the east. It occupies 51,000 square feet, and is estimated to average 20 feet in depth and to contain 1,020,000 cubic feet of tailings.

Intentions to continue stacking the tailings on around the mountain spur are indicated by the leveling and ditching (for drainage into a sump) of a new tailings area. The new tailings area measures 300 by 575 feet, or 172,500 square feet.

Capacity and Production

Capacity

Two methods are available for estimating the capacity of the Mayli-Say uranium mill. One method is based on the size of the thickeners and the other on the volume of material processed as represented by the tailings. The two 75-foot-diameter thickeners are estimated to have a capacity of 880 to 1,100 metric tons per day, based on one ton per day for each [redacted] square feet of thickener cross-section (see Table 2).

25X1D The dump area is 763,400 square feet and is estimated to contain 41,339,000 cubic feet of solids (see Table 3). On a volume basis of 17 cu-

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TABLE 3. DIMENSIONS AND ESTIMATED CAPACITY OF THE TAILINGS DUMP AND UNFILLED DUMP AREAS.

Area	Estimated Area (sq ft)	Estimated Height (ft)	Estimated Volume (cu ft)	Quantity (metric tons)(*1)	Estimated Time to Fill (mo)	Estimated Area (sq ft)	Estimated Future Height (ft)	Estimated Volume (cu ft)	Quantity (metric) tons)(*1)	Estimated Time to Fill (mo)
	TAILINGS DUMP					UNFILLED AREAS				
Lower Terrace	171,800	25	19,085,000	1,116,735	33	1,300	25	167,500	9,801	0.7
Middle Terrace	347,500	30	17,748,000	1,038,320	42	5,400	30	162,000	9,479	
Upper Terrace	193,100	20	3,486,000(*2)	203,943	8	-	20	-	-	-
Slurry Pond	51,000	20	1,020,000(*3)	14,918(*3)	-	51,000	20	765,000(*5)	38,155(*3)	1.3
New Tailings Area	-	-	-	-	-	172,500	95(*4)	9,470,250	552,054(*3)	18.4
Totals	763,400	-	41,339,000	2,373,200	83	235,200	-	10,564,750	609,489	20.4

(*1) Computed on the basis of 17.09 cubic feet/metric ton or 129 pounds per cubic foot.

(*2) An east-west "valley" traversing the north end of the upper terrace occupies 18,800 square feet of area, which has been filled to an average estimated possible height of 5 feet.

(*3) Computed on the basis of an accumulation of solids to a depth of 20 feet. Estimated weight of the solids is 110 lbs/cubic foot or 20.05 cubic feet per metric ton.

(*4) Total height formed by extension of preceding four areas (three terraces and slurry pond areas).

(*5) Calculated by reducing volume of 1,020,000 cubic feet by 25 percent for estimated content of already suspended solids.

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bic feet of tailings per metric ton (129 pounds per cubic foot) the dump is computed to contain 2,373,000 metric tons of waste. Allowing 3-4 years for design, manufacture, assembly, and try-out of the mill from 1946, the plant is assumed to have been between 7 and 8 years old at the time of the photography. Under pressure of high-operating priority the mill may have operated 360 days per year. Assuming 7 years of operation, an average of 941 metric tons of ore per day -- falling within the range of 880 to 1,100 metric tons computed by the first method -- would have been processed.

Production

Uranium mills have a history of rapidly climbing production rates. Thus the actual 1957 production rate at Mayli-Say should be higher than the 7-year average. Initial production probably began with one thickener sometime in 1950, with partially assembled inside equipment, and incompletely developed mines. No recent expansion of the mill can be seen and, if 2 years are allowed for bringing the plant to full operation, it may be assumed that by 1957, production had leveled off to 1,000 metric tons of ore processed daily.

There is little information available concerning the grade of the Mayli-Say ore. Samples cited in the literature on the area are selective and might not represent the average ore grade. Therefore, Table 4 shows estimated annual production of uranium oxide equivalent based on ore grades of 0.2 and 0.3 percent.

The US Geological Survey report, published in 1954, estimated that the Mayli-Say ores might have furnished as much as 500 tons of uranium, but were then probably exhausted. 2/ Data developed in Table 4 indicates production through 1953 ranged from 1,800 to 2,700 metric tons. The photography of [redacted] shows that the mines were not then exhausted, and the [redacted] photography, although unsuitable for detailed interpretation, does indicate that the mines are still in operation.

25X1D
25X1D

TABLE 4. ESTIMATED ANNUAL PRODUCTION OF URANIUM OXIDE EQUIVALENT AT MAYLI-SAY.				
Year	Quantity treated (metric tons)	Estimated recovery efficiency (percent)*	Uranium oxide equivalent recovered 0.2 Grade (metric tons)	0.3% Grade (metric tons)
1950	250,000	75	375	567
1951	270,000	80	432	648
1952	300,000	80	480	720
1953	320,000	80	511	768
1954	330,000	85	561	841
1955	340,000	85	578	885
1956	350,000	85	600	890
1957**	210,000	85	357	535
Total	2,370,000		3,894	5,854
Annual average recovery (for 7½ years)			520	790

* This estimate assumes that high government priority, technological improvements, and greater operating experience have brought about a gradual increase in the efficiency of uranium oxide extraction from 75 to 85 percent. The increased recovery efficiency by the operators of the Mayli-Say mill is assumed to parallel roughly US extraction experience. The possibility that the Mayli-Say mill operators are not utilizing the resin-in-pulp recovery process or are not experienced in its use precludes assigning them a 90 percent or better efficiency rating reached in the US.

** Estimated production through the time of photography, [redacted] 25X1D

Reserves

One indication of the size of the Mayli-Say district's ore reserves is the preparation of a new tailings area southwest of the tailings area south of the mill. The new tailings area measures 300 by 575 feet, and contains 172,500 square feet. The new areas undergoing preparation presumably will be filled by continuing the three terraces and the slurry pond, as has been indicated in Table 3. At the present rate of tailings accumulation (360,000 metric tons per year), the new tailings areas would be filled in about 20 months from the date of the photography. There is some evidence -- such as the cutting away of a mountain spur still farther south and near the level of the upper tailings terrace, and the leveling of a mountain spur west of the tailings dump -- that the Soviet engineers

are beginning to prepare still newer ground for tailings. This suggests that reserves at Mayli-Say are sufficient to last at least 3 years.

Relationships to Other Plants

There is a possibility of the existence of a uranium mill at Andizhan but thus far no such installation has been located. A careful search was conducted of other surrounding towns but no mineral processing mill was discovered. The Mayli-Say ores, after some preliminary concentration, might have been shipped to the mill at Ispisar for upgrading. After the Mayli-Say mill was built about 1950, a high-grade concentrate was produced that probably was shipped directly to a metal refinery rather than to Ispisar for upgrading.

SUPPORT FACILITIES

For the most part, support facilities are located near the mill area and in Mayli-Say, although there are other facilities near the Andizhan railroad station. Housing in the area would accommodate an estimated 4,350 people. Water and electric power are available at the site although the supply of power probably has to be supplemented by the regional grid.

Chemical Supply

For a mill the size of Mayli-Say a variety of chemicals would be required. Only two chemical groups can be identified from aerial photos.

Powder Reagent

A powder, possibly sodium carbonate, is seen spilled on all sides of a storage building (building 14, Figure 4) located 150 feet north of the

northwest corner of the mill. This building, with a volume of 92,750 cubic feet, can store a maximum of approximately 2,500 tons of powdery chemicals such as sodium carbonate. The comb of its gable roof has seven ventilators, probably to remove dust and to cool the building's contents. The powder is probably trucked from the storage building to the small conveyer at the northwest corner of the crushing and grinding building.

At Andizhan II Railroad Station, on the north side of the city (see Figure 2), there is a large supply dump. Alongside the railroad tracks is a rectangular building, served by two spurs having much spillage of a whitish powder similar to that seen near the mill at Mayli-Say.

Liquid Reagent

The second chemical group, or liquid reagents, are stored in four tanks located in the southeast corner of the court adjoining the mixing and agitation building (building 8). The tanks occupy an area 40 by 35 feet, and have a combined volume of 11,000 cubic feet or a capacity of 82,250 gallons.

At Andizhan II, no tanks for liquid reagents are seen, although they may be inside the rectangular building. The liquid reagents could also be procured from the tanks of a general chemical supply dump located in another part of Andizhan.

Water Supply

There is an abundance of water at Mayli-Say, derived from 1) ground water from the great cliff above the mill and 2) stream water from the runoff of high mountains north of the uranium district. A probable water pipeline passes from building 7, to the corner of the mill area, 700 feet away, where the water is distributed to the fine grinding hall, mixing and agitation building, and filtration hall as well as to the thickeners.

Considering various uses of water within the mill, the amount of water in the slurry pond, and the amount of water required to treat the ore (estimated at 662 gallons per ton) the mill would require about 700,000 gallons of water per day. This requirement is probably not greater because of frequent recycling of the mill product within the circuit to raise the concentration of uranium.

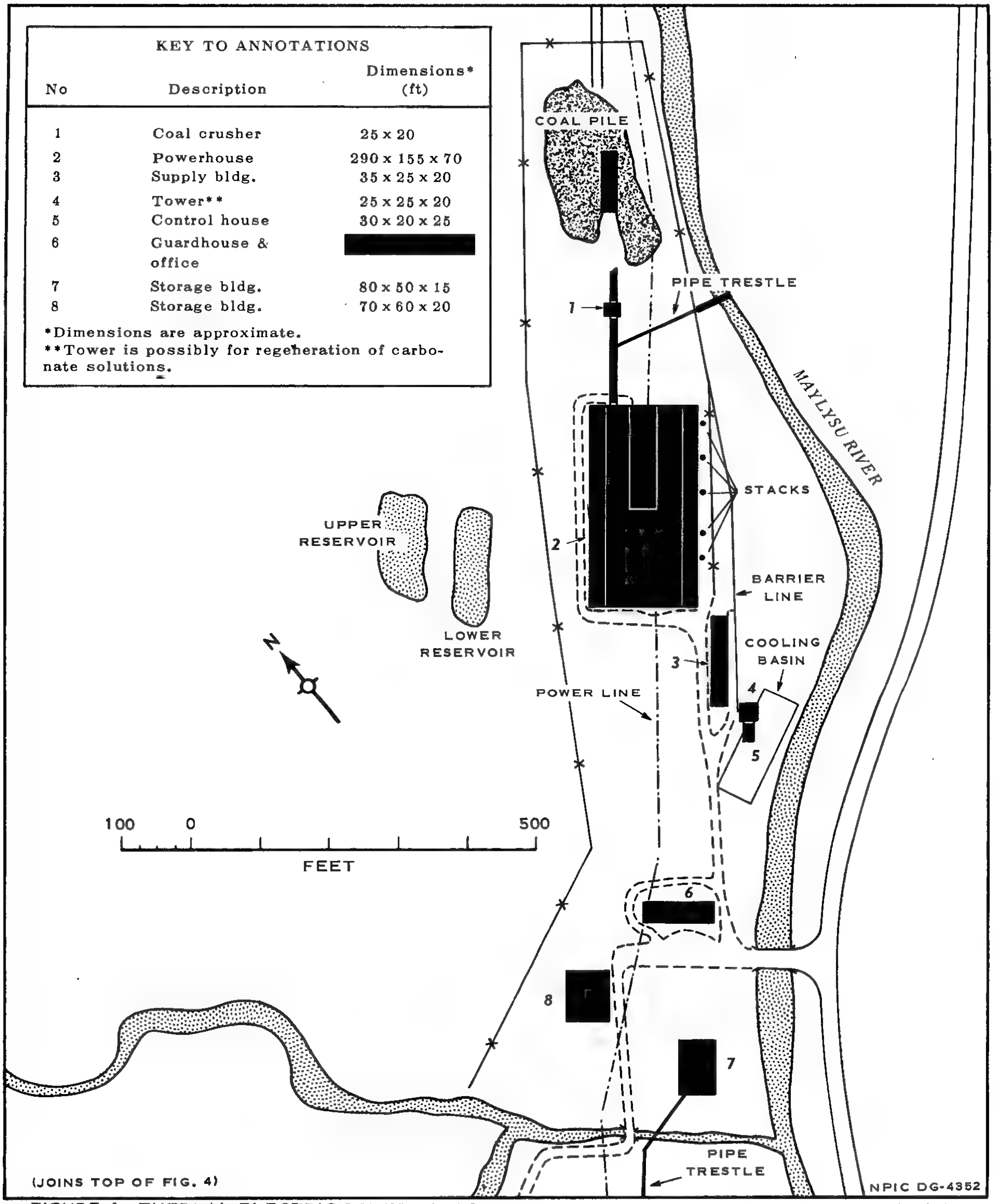
A pipeline to supply mine No 2 travels 1.5 miles up the steep slopes of Gora Kol'men from a surge tank and a pumping station along the Maylisu river. The pumping station is located about halfway between the Mayli-Say town site and the uranium mill site. The pipeline probably has a diameter of a foot or more, since it is clearly visible where it crosses draws or ravines.

Electric Power

A thermal power plant (building 2, Figure 6) is located 1,500 feet north of the uranium mill. The power plant is estimated to have a generating capacity of 15,000 to 24,000 kilowatt-hours, depending on whether there are four or five new generator units.* The power plant can thus generate the ordinary power requirements of the Mayli-Say uranium complex as estimated in Table 5. If an interruption should occur to the regional grid supply of electricity, the local plant, supplemented by small facilities at the more distant mines, could supply the minimal power requirements. Supplemental power requirements are probably furnished by a more distant source of power, generated for the regional grid by oil and gas in the Maylisu valley or by hydroelectric power from dam sites of the still more distant river installations of the Fergana valley. A series of steel pylons, 100 or more feet high, are barely visible in the Maylisu valley below the mill, indicating a possible tieline to the Uzbek regional grid, via the town of Mayli-Say.

* One 5-megawatt generator is estimated to occupy 22 linear meters (71 feet) of the generator hall. The 290-foot-long generator hall is of sufficient length to accomodate four generators.

25X1D



KEY TO ANNOTATIONS

No	Description	Dimensions* (ft)
1	Coal crusher	25 x 20
2	Powerhouse	290 x 155 x 70
3	Supply bldg.	35 x 25 x 20
4	Tower**	25 x 25 x 20
5	Control house	30 x 20 x 25
6	Guardhouse & office	[redacted]
7	Storage bldg.	80 x 50 x 15
8	Storage bldg.	70 x 60 x 20

*Dimensions are approximate.
**Tower is possibly for regeneration of carbonate solutions.

FIGURE 6. THERMAL ELECTRIC POWER PLANT, MAYLI-SAY, USSR. Plant is located just north of the uranium plant.

Coal Mining Facilities

Brown coal is dumped into a ring-shaped pile surrounding a possible concrete platform at the power plant. The pile is retained, on the Mayli-su river side, by a retaining wall. The brown coal pile is estimated to contain about 1,000 tons, or an 8-day supply. The larger darkened area surrounding the brown coal pile probably indicates that the pile was once much larger.

TABLE 5. ESTIMATED ELECTRIC POWER REQUIREMENTS OF THE MAYLI-SAY COMPLEX.

Consumer	No Units	Power Requirements (KWH)	Source
Coal mines	3	200	ORR estimate
Coal processing plant	1	200	ORR estimate
Coal supply base	1	200	Author's estimate
Communal facilities:			
Dwellings	1,500	300	Estimated to use .04 kwh each, plus auxiliary lights and pumps
Other*	-	500	Author's estimate
Uranium facilities:			
Mill	-	8,000	Hannay, R.L., in Canadian Mining Journal. vol 77, Jun 56, p 135
Mines	13	8,000	Peele,R., and Church, J.A. Mining Engineers' Handbook 50, Section 40, p 3
Supply base	1	200	Author's estimate
Water pumping station	1	100	Peele and Church, op. cit. Section 21
Total		17,700	

* Includes several garages, numerous supply buildings, headquarters, laboratories, a theater, street, floodlights, etc.

TABLE 6. ESTIMATED HOUSING OF THE MAYLI-SAY COMPLEX, [redacted] 25X1D

Type of Housing	Structures	Persons
Mining, milling, and support personnel		
Probable family housing	93	1,420
Quarters for single persons	57	1,226
Subtotal	150	2,646
Other personnel		
Isolated dwellings	190	1,140
Native villages and areas (3)	67	400
Undistributed	30	200
Subtotal	287	1,740
Grand Total	437	4,346

Housing Facilities

Housing facilities are available for an estimated 4,350 people (including dependents and natives) in the Mayli-Say uranium mining district. The proportion of people engaged in the extraction of uranium is unknown, and probably varies from season to season. Possibly 80 to 90 percent of all persons in the district obtain their livelihood directly or indirectly from uranium mining or milling. The remainder probably are engaged in agriculture and road building and maintenance. Table 6 illustrates the disposition and numbers of the main population groups. The table is based on the assumption that the family dwellings and quarters house families of five. It is further assumed that each of the native quarters would be occupied by an average of six persons.

On the basis of the foregoing considerations a plausible work-category distribution of the housing facilities and their tenants and of other buildings in the complex is shown in Table 7.

Mayli-Say town located 2 miles south (downstream) of the mining complex, is probably only indirectly concerned with uranium. The city acts as a rayon administrative center, a maintenance base, and a housing area for some workers in the uranium complex.

TABLE 7. DISTRIBUTION OF PERSONNEL, HOUSING, AND OTHER FACILITIES, MAYLI-SAY AREA.

Work Category	Dwellings	Apartment Bldgs	Auxiliary Bldgs	Supervisors or Technicians	Workers	Total
Coal mining	8	19	9	24	344	368
Coal preparation and supplies	-	8	7	12	84	96
Subtotal	8	27	16	36	428	464
Uranium mining and milling	43	21	27	94	336	430
Powerhouse	-	10	-	16	200	216
Supply base and transport	6	11	7	22	56	78
Security or control	-	2	3	2	24	26
Administration, planning and technical personnel	-	22	1	82	214	296
Total	57	93	54	252	1,258	1,510

Storage and Supply Facilities

On the east side of the Maylisu river, across from the powerhouse, is a relatively large and generally bare area which serves as an immediate or forward supply base for the uranium mines, mill, and powerhouse. Two long and low rectangular storage buildings dominate the unfenced supply base. Some equipment is scattered about the area near the main highway. A small enclosed area between the two rectangular storage buildings may serve as a POL base. Along the north side of the storage base there is a corral for horses or mules which probably are used to move supplies in otherwise inaccessible mountain regions. Near the Maylisu river and south of the two rectangular storage buildings is a high, L-shaped pile of possible mine timbers or pit props. Despite the large volume of material excavated in the uranium mines, the quantity of pit props is not as large as the long rows of possible pit props seen in the coal mine supply base.

Explosive Storage

For a mining district the size of the Mayli-Say there are surprisingly few enclosed areas or fenced-in compounds capable of storing explosives. Two small, enclosed areas are located near mines 2 and 15 but they lack the characteristic bunkers used by the Russians for storing mining explosives.

The blasting of well-consolidated limestone requires about one pound of explosive per ton of limestone. 5/ At a daily mining rate of ore and rock of 1,100 to 1,200 tons approximately 1,100 to 1,200 pounds of explosives are required per day. At this rate of consumption it is likely that an explosives magazine and enclosure exists somewhere in the Mayli-Say uranium complex to supply adequate mining explosives without delay.

Andizhan II Supply Base

West of the Andizhan II railway station, on the north side of the city of Andizhan, there is a large dump believed to be for the use of the Mayli-

Say uranium operation. Two railway spurs serve the rectangular building mentioned above. North of the rectangular building are numerous rows of stacked supplies, one group of which appears to be poles or pit props.

A source states that on entering Andizhan II railway station an industrial plant was noted on the left about 100 yards from the tracks. 6/ The plant consisted of a square building with one stack, and two rectangular buildings, each 150 by 100 feet. Each of the rectangular buildings had five vertical, narrow ventilators extending several feet above the roof. On the left side of the tracks is a storage area in which [redacted] diameter piping, lumber, and [redacted] diameter gears are stored. 25X1D

25X1D

Transportation

The Mayli-Say uranium district is served by a blacktop road from Andizhan to Mayli-Say. The two-lane road follows a generally straight course and goes up the valley by an easy grade along the Maylisu. Above Mayli-Say the road to the mill and mines is a two-lane highway which has a whitish tone probably produced by mill tailings.

Secondary roads generally have a metaled appearance produced by a gravel or sandy surface. The steep grades of the mountain roads necessitate their winding back and forth with very sharp turns.

The Mayli-Say uranium complex is distinguished for its lack of highway traffic, particularly considering the tonnage of coal, ore, and supplies which must be moved. Most of the traffic observed (16 vehicles) is on the main road to the town of Mayli-Say, and appears to be rapidly moving passenger cars. In the center of the Mayli-Say uranium complex across the highway from the uranium supply base are four low garagelike structures, which could house an estimated 28 vehicles. Heavy-duty trucks are probably parked outside in the supply base itself when not in use. Well-worn roads lead to special loading facilities at the mines, to piles of pit-props, warehouses, and unloading facilities at the mill and the powerhouse.

Security

Military Security

As indicated on Figure 3, three antiaircraft batteries are located on prominent mountainside positions around the Mayli-Say uranium district. Each battery has eight positions, all of which appear to be unoccupied. In addition to the foregoing batteries, there are three abandoned positions located near the Maylisu defile. The batteries were possibly moved outward to higher positions as the uranium complex expanded.

In the city of Mayli-Say are a number of large buildings, which might serve as barracks, with a nearby parade ground. Soldiers from the Mayli-Say barracks and those occupying positions on the mountain tops west of the city can control any movement into the mining area from the south. Soldiers in a number of barrackslike structures on the steep slopes of the mountain situated to the west of the mill could also command traffic to and from Tashkumyr to the west.

Police Security

Few roads run in and out of the Mayli-Say uranium mining district. On a mountain road a control house can be seen to the east of and high above the city of Mayli-Say. Traffic into the Mayli-Say Complex appears to be controlled by a checkpoint building and fenced enclosure located at the south end or outlet of the Maylisu river defile. Traffic from the complex is less closely controlled but is believed to be scrutinized from a two-story building within a wall-type enclosure located in the defile of the Maylisu river.

Plant Security

The mill area is secured on the west, north, and east sides by a protective fence. A second and lower fence can be seen at places outside the

security fence. The south side of the mill area has no security fence, but it would be difficult to enter or to escape observation while crossing the mill dump or the banks of the Maylisu.

A guardhouse or office building (building 6, Figure 6) stands at the main bridge for the purpose of traffic control. A second guardhouse (building 13) is located at the northwest corner of the plant, and controls traffic into the mill court and farther south into the tailing dump area.

CONCLUSIONS

The foregoing analysis of the photography of the Mayli-Say complex makes it possible to draw the following conclusions:

1. At least 13 mines are supplying ore for the uranium concentration plant two miles north (above) of the city of Mayli-Say.

2. The concentration plant has an estimated capacity for processing 1,000 tons of ore daily.

3. The plant is a large modern installation, probably using the carbonate leach process of uranium ore concentration.

25X1D

4. Total output of uranium oxide equivalent by the Mayli-Say plant, [redacted], is estimated to fall within a range of 3,900 to 5,850 metric tons.

5. It is estimated that 700 tons of uranium oxide concentrate were
25X1D produced in [redacted] by this plant.

6. A supply base at Andizhan II is probably related to the Mayli-Say operation. 25X1D

25X1D

7. On the basis of the examination of the [redacted] and [redacted] it is clear that the mines were still in operation in [redacted] although 25X1D
it is impossible to estimate production subsequent to [redacted]

25X1D

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25X1D

PHOTOGRAPHY

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MAPS AND CHARTS

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USSR. Geological and Prospecting Service Pub. No 9, Plate 1 (Insert) (Geological map of the Coal Deposit Along Maylisu River), 1927, scale 1:25,000 (U). This map shows contours for the Sary-biya valley, which were incorporated in the USSR General Staff Map cited above.

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